Operational Problems and Heuristic Modeling

In recent years, the application of heuristics to large, difficult to solve problems has become an increasingly significant area of research. Tabu search, genetics algorithms, simulated annealing, and other heuristics have been applied to a wide range of problems. The application areas include scheduling, routing, and resource allocation problems. Sponsors include Air Mobility Command, the UAV Battlelab, Air Force Space Command, United States Strategic Command, Air Force Research Labs, and the Air Force Office of Scientific Research.

Research Areas

Combat Modeling
Combat Planning
Mobility Modeling
Resource Allocation
Scheduling
Vehicle Routing
Pallet Packing

Recent Findings

Heuristics have been successfully applied to combat planning, tanker scheduling, UAV routing, weapon allocation, pallet packing, and surveillance aircraft location problems.

Modeling Resources

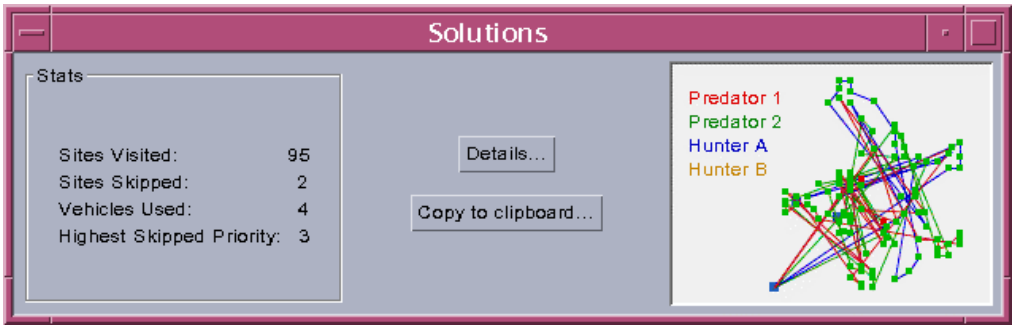
Tanker Assignment Problem (TAP) Tool: This tool was built in an Excel spreadsheet using visual basic for applications. The model is capable of providing tanker mission plans for deployment scenarios. The tool allows Air Mobility Command to input several receiver groups and the locations of military tanker aircraft. The TAP tool assigns the tankers to the different refueling points of the receiver groups so that all receiver groups arrive before their required delivery date. The model allows the reuse of tankers and uses the heuristic technique tabu search to determine the assignment of tankers to receiver groups.

For further information or to suggest a related thesis topic, please contact:

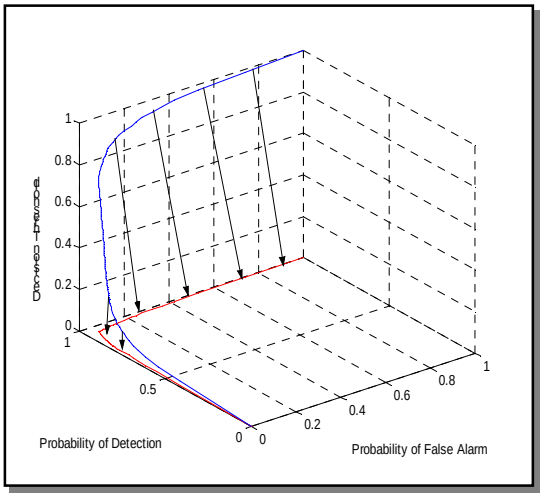
Dr. Kenneth W. Bauer, Jr.
Dr James W. Chrissis
Dr Richard F. Deckro
Lt Col Raymond R. Hill
Lt Col J.O. Miller
Dr James T. Moore
LTC William P. Nanry

Departmental web site: http://en.afit.edu/ens/

UAV Route Planner



Statistical Analysis



Research Areas

Neural Nets
Evaluation of Classifiers
Response Surface Methodology
Statistical Process Control

Recent Findings

Receiver Operating Characteristic (ROC) curves is commonly used for summarizing the performance of imperfect diagnostic systems such as Automatic Target Recognition devices. Recently, we proposed a family of metrics for comparing two ROC curves that enable a proof of convergence for these curves. This ROC convergence theorem is useful because it provides a framework for the comparison of ROC curves and hence, the comparison of classifiers. We applied our proposed metrics to several real world diagnostic problems to demonstrate how our proposed metrics can eliminate the ambiguity that can result when the ROC curves of competing classifiers overlap.

Another recent effort focused on feature selection and reduction of the psycho-physiological features and subsequent classification of pilot mental workload on multiple subjects over multiple days. A stepwise statistical technique and the signal-to-noise (SNR) saliency metric were used to reduce the number of features required for classification. Factor analysis was used to compare the variables chosen by the discriminant procedure and the SNR saliency metric as applied to a neural network. Most recently, an effort identified a common feature space for the classifiers, which boosted generalization more than 50%.

Dr. Kenneth W. Bauer, Jr.
Capt Stephen P. Chambal; Lt Col Raymond R. Hill
Lt Col J.O. Miller; LTC William P. Nanry
Departmental web site: http://en.afit.edu/ens/